**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

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| Appellant: | Basir et al. | Group Art Unit: | 3663 |
| Serial No.: | 10/783,390 | Examiner: | Gooden, Jr., Barry J. |
| Filed: | 02/20/2004 | Confirmation No.: | 6422 |
| Title: | ADAPTIVE VISUAL OCCUPANT DETECTION AND CLASSIFICATION SYSTEM | | |

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

## APPEAL BRIEF

Subsequent to the Notice of Appeal electronically filed with the Patent and Trademark Office on June 18, 2008, and the Decision on PreAppeal Brief Request for Conference mailed August 1, 2008, Appellant now submits its Brief. If any further fees or extensions are necessary, you are hereby authorized to charge Deposit Account No. 50-1482 in the name of Carlson, Gaskey & Olds.

## REAL PARTY IN INTEREST

The real party in interest, Intelligent Mechatronic Systems Inc., is the Assignee of all right and title in this Application from the inventors, and this assignment was recorded on May 26, 2004 at Reel/Frame 015396/0771.

## RELATED APPEALS AND INTERFERENCES

There are no related appeals or interferences.

## STATUS OF CLAIMS

Claims 1-14 and 25-38 are presently pending in the application. Claims 1-14 and 25-38 stand finally rejected. Claims 15-24 have been cancelled. The rejections of claims 1-14 and 25-38 are being appealed.

## STATUS OF AMENDMENTS

There are no unentered amendments.

## SUMMARY OF THE CLAIMED SUBJECT MATTER

This invention relates to the field of image-based vehicle occupant detection and classification. More specifically, the invention uses an imaging system in order to classify a vehicle seat into a number of occupancy classes, the minimum of which includes (i) empty, (ii) occupied by an adult passenger, (iii) occupied by a child passenger, (iv) occupied by a forward facing infant seat, (v) occupied by a rear facing infant seat. One purpose of the classification is to control deployment of an airbag, by either choosing not to deploy the airbag (in the case of a rear-facing infant seat or a child occupant), or by altering the amount of force of deployment of the airbag.

Claim 1, for example, recites capturing an image 122 (Figure 3) of an occupant area in a vehicle 22 (page 9, lines 7-10; Figure 1) and dividing the image into a plurality of subimages 122 of predetermined spatial regions (page 10, lines 15-18; Figure 3). A spatial feature matrix 47 of the image is generated based upon the plurality of subimages 122. (page 11, lines 1-7; Figure 3). The occupant in the occupant area is then classified based upon analyzing the spatial feature matrix 47 (page 11, lines 6-7; Figure 3). The occupant is classified into a classification, wherein the classifications include: adult and child (page 11, lines 10-14; Figure 3).

Claim 25 recites, capturing an image 120 of an occupant area in a vehicle 22 (page 9, lines 7-10) and dividing the image 120 into a plurality of subimages 122 of predetermined spatial regions (page 10, lines 15-18; Figure 3). A plurality of low-level descriptors is generated from each of the plurality of subimages 122. (page 11, lines 1-7; Figure 3). The low-level descriptors are analyzed. Claim 25 then recites, "classifying an occupant in the occupant area based upon analyzing low-level descriptors into one of a plurality of classifications, wherein the classifications include: infant seat."

Claim 34 recites, capturing an image 120 of an occupant area in a vehicle 22 (page 9, lines 7-10; Figure 3) and dividing the image into a plurality of subimages 122 of different predetermined spatial regions (page 10, lines 15-18; Figure 3). A spatial feature matrix 47 of the image is generated based upon the plurality of subimages 122. (page 11, lines 1-7; Figure 3). The spatial feature matrix 47 is analyzed and it is determined whether the occupant area is occupied by a person based upon the analysis of the spatial feature matrix 47. (page 10, lines 7-13; Figure 3).

## GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Appellant seeks review of the following grounds of rejection:

I. Claims 1-9, 14, 25-29 and 32-38 have been rejected as obvious over Kung (US 5,850,470) in view of Christi (US 20040176891).

II. Claims 10-13, 30 and 31 have been rejected as obvious over Kung, Christi and further in view of Baloch (US 645997).

## ARGUMENTS

I. Claims 1-9, 14, 25-29 and 32-38 have been rejected as obvious over Kung (US 5,850,470) in view of Christi (US 20040176891). Kung discloses a "Neural Network for Locating and Recognizing a Deformable Object." The specific "deformable object" to which the Kung invention is directed is the human face. In other words, Kung provides a face recognition system. The Kung face detection system is intended to be used for "finding and identifying a specific but locally deformable pattern in an image, such as a human face." (col. 1, lines 14-16). Face recognition is used for "person identification" such as for "ATM access, access control, surveillance and video conferencing." (col. 1, lines 18-22). The entire disclosure of Kung is directed toward *identifying* a face as a specific, known person in a databse: "In any case, once the face has been located, the system then compares the face to other faces stored in the database in order to identify the person."

Christi does not disclose classifying a person based upon a spatial feature matrix. Christi does classifying an occupant, but not based upon a spatial feature matrix. Therefore, even if the references were somehow combined (which does not make sense), the claims would still not be met.

Claims 1-9, 14, 25-29, 32-33

The Examiner first states, "Kung et al. teaches a system/method for classifying an occupant . . ." (Final Rejection, page 3) and then states, "Kung et al. merely fails to disclose 'classifying an occupant in the occupant area based upon said step (d), which is analyzing the spatial feature matrix, into a classification wherein the classification include: adult and child." (Final Rejection, page 3). The Examiner has clarified his position that Kung discloses "classifying an occupant in an area based on analyzing spatial matrix." (Final Rejection, page 7). Appellant disagrees.

Based upon the Examiner's explanation of the rejection, it is not clear whether the Examiner really proposes to modify the Kung face recognition system in view of the Christi occupant classification system or to modify the Christi occupant classification system in view of the Kung face recognition system. Neither combination would make sense or yield the claimed invention.

First, Kung does not *classify* an occupant as the Examiner states. Kung *identifies* a person (for example, for accessing an ATM), but only if that person is known in the database. Kung provides no "classification" of the person, contrary to the Examiner's position (Final Rejection, page 3). Therefore, even if Kung were somehow modified as proposed by the Examiner in view of Christi, Kung and Christi would not meet the terms of claims 1 and 25.

All of the algorithms in Kung are directed toward comparing the face of the person with stored images in a database in order to identify a person. None of these teachings would be useful in *classifying* a person. In particular, none of these teachings would be useful for *classifying* a person as "adult or child," as recited in claim 1. Nor would these teachings be used for a classification such as "infant seat," as recited in claim 25. Nor would these teachings be used to determine whether the occupant area is occupied, as recited in claim 34.

It would not be acceptable to include a system like Kung's in a vehicle occupant classification system. It would not be useful to identify occupants because identifying them would not give any information relative to how the occupant safety systems should perform. It

would further be unacceptable to only be able to identify (or even somehow classify) only those occupants whose faces were previously stored in a database on that particular vehicle because the system would not work for guest passengers (even assuming that the owners of the vehicle were willing and able to create and update a database of the faces of the regular occupants of the vehicle).

Claim 25

Additionally, claim 25 recites that the classifications include: infant seat. Kung's "face recognition" system does not determine whether an infant seat is present. The Examiner states that Christi discloses detecting an infant seat, but it is admittedly not done based upon "analyzing the low-level descriptors," as claimed.

Claim 32

Claim 32 depends from claim 1 and further recites "determining the classification of the occupant from among the classifications including: adult, child and infant seat." Again, Kung's face recognition system does not do this. The Examiner states that Christi does this, but Christi does not do this "based upon said step d)" i.e. analyzing the spatial feature matrix.

Claims 34-38

Claim 34 does not include the step of "classifying" discussed above with respect to independent claims 1 and 25 and claims dependent therefrom. Claim 34 recites, "determining whether the occupant area is occupied by a person based upon said step d)" i.e. "analyzing the spatial feature matrix." Kung does not have anything to do with an "occupant area in a vehicle" and does not relate to whether an occupant area of vehicle is occupied or not. It would not be logical to use a face recognition system that relies on a database of known faces in order to determine whether there is an empty seat in a vehicle.

Clam 35

Claim 35 depends from claim 34 and further recites "determining whether the person is an adult or a child." The Kung system does not do this. The Examiner simply states that Christi

determines whether the occupant is an adult or a child, but this has nothing to do with face recognition or analysis of a spatial feature matrix.

Claims 36-38

The Examiner merely states that the classifications and determinations of claims 37-38 are performed by Christi. However, all of these claims require that the classifications and determinations are "based upon analysis of the spatial feature matrix." Since the Examiner admits that Christi does not disclose analysis of a spatial feature matrix, Christi does not perform the features of claims 36-38. Kung's face recognition system would not perform these features either.

II. Claims 10-13, 30 and 31 have been rejected as obvious over Kung, Christi and further in view of Baloch (US 645997).

Claims 10 and 30

Claims 10 and 30 recite, "altering the orientation or the location from which the image is captured and adjusting the system parameters." The Examiner argues that this is shown in Baloch, but (whether or not it is), this does not make sense in the Examiner's proposed Kung / Christi system. Kung is a face recognition system. There are no "orientations" or "locations" to alter and no "system parameters" to adjust because the Kung system must be looking at the face to be identified.

## CLOSING

For the reasons set forth above, the final rejection of all claims is improper and must be reversed.

Respectfully submitted,

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## CLAIMS APPENDIX

1. A method for classifying an occupant including the steps of:

a. capturing an image of an occupant area in a vehicle;

b. dividing the image into a plurality of subimages of different predetermined spatial regions;

c. generating a spatial feature matrix of the image based upon the plurality of subimages;

d. analyzing the spatial feature matrix; and

e. classifying an occupant in the occupant area based upon said step d) into a classification, wherein the classifications include: adult and child.

2. The method of claim 1 further including the step of processing the image to account for lighting and motion before said step d).

3. The method of claim 1 further including the step of smoothing the classification of the occupant over time.

4. The method of claim 1 further including the step of determining whether to activate an active restraint based upon the classification of said step e).

5. The method of claim 1 wherein said step d) further includes the step of applying expert classifier algorithm to the spatial feature matrix.

6. The method of claim 5 wherein said step d) further includes the step of analyzing the spatial feature matrix based upon a set of training data.

7. The method of claim 6 further including the step of creating the set of training data by capturing a plurality of images of known occupant classifications of the occupant area.

8. The method of claim 5 wherein the expert classifier algorithm includes a neural network.

9. The method of claim 1 wherein said step d) is based upon system parameters including an orientation or a location from which the image is captured relative to the occupant area in said step a).

10. The method of claim 9 further including the step of:

altering the orientation or the location from which the image is captured and adjusting the system parameters.

11. The method of claim 10 wherein said step f) further includes the step of entering physical data representing a physical orientation and location of the occupant area.

12. The method of claim 10 wherein said step f) further includes the step of capturing a calibration image of the occupant area in a known condition and determining the system parameters based upon the calibration image.

13. The method of claim 12 wherein said step f) further includes the step of placing a calibration pattern on the occupant area before the step of capturing the calibration image, such that the calibration image includes the calibration pattern.

14. The method of claim 1 wherein the plurality of subimages partially overlap one another.

25. A method for classifying an occupant including the steps of:

a) capturing an image of an occupant area in a vehicle;

b) dividing the image into a plurality of subimages of different predetermined spatial regions;

c) generating a plurality of low-level descriptors from each of the plurality of subimages;

d) analyzing the low-level descriptors; and

e) classifying an occupant in the occupant area based upon step d) into one of a plurality of classifications, wherein the classifications include: infant seat.

26. The method of claim 25 wherein said step d) further includes the step of analyzing the low-level descriptors based upon a set of training data.

27. The method of claim 26 further including the step of creating the set of training data by capturing a plurality of images of known occupant classifications of the occupant area.

28. The method of claim 25 wherein said steps d) and e) are performed using a neural network.

29. The method of claim 25 wherein said step d) is based upon system parameters including an orientation or a location from which the image is captured relative to the occupant area.

30. The method of claim 29 further including the step of:

f) altering the orientation or the location from which the image is captured and adjusting the system parameters.

31. The method of claim 30 wherein said step f) further includes the step of entering physical data representing a physical orientation and location of the occupant area.

32. The method of claim 1 wherein said step e) further includes the step of determining the classification of the occupant from among the classifications including: adult, child and infant seat.

33. The method of claim 32 wherein said step e) further includes the step of determining the classification of the occupant from among the classifications including: adult, child, forward-facing infant seat and rearward-facing infant seat.

34. A method for classifying an occupant including the steps of:

a) capturing an image of an occupant area in a vehicle;

b) dividing the image into a plurality of subimages of different predetermined spatial regions;

c) generating a spatial feature matrix of the image based upon the plurality of subimages;

d) analyzing the spatial feature matrix; and

e) determining whether the occupant area is occupied by a person based upon said step d).

35. The method of claim 34 further including the step of, if it is determined that a person is present in said step e), determining whether the person is an adult or a child based upon said step d).

36. The method of claim 34 further including the step of, if it is determined that a person is present in said step e), determining whether the person is in an infant seat based upon said step d).

37. The method of claim 36 further including the step of, if it is determined that the person is in an infant seat, determining whether the infant seat is forward facing or rearward facing based upon said step d).

38. The method of claim 34 further including the step of, if it is determined that no person is present in said step e), determining whether an object is in the occupant area based upon said step d).

## EVIDENCE APPENDIX

None.

## RELATED PROCEEDINGS APPENDIX

None.